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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/759,312 | 01/12/2001 | Yoshihiro Ueta | 299002051800 | 1784 |

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MORRISON & FOERSTER LLP
755 PAGE MILL RD
PALO ALTO, CA 94304-1018

EXAMINER

MULPURI, SAVITRI

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|----------|--------------|
| ART UNIT | PAPER NUMBER |
|----------|--------------|

2812

DATE MAILED: 03/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|-----------------|--------------|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 09/759,312 | UETA ET AL. | |
| | Examiner | Art Unit | |
| | Savitri Mulpuri | 2812 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 December 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-4,6-7 and 12-19 is/are pending in the application.
- 4a) Of the above claim(s) 8-11 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,6,7 and 12-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>6/18/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This action is in response to the applicant's communication, amendment to claims, filed on 12/28/2004.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1,3-4, 6-7,12-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura et al (US 6,201,823) in combination with Zauner et al (publication by material research society).

Kimura et al discloses a compound semiconductor light emitting device having semiconductor multilayer structure on a sapphire substrate, wherein multilayer structure comprises acceptor doping layer and evenly formed of multi quantum well active layer '107' with several period of alternating quantum well and barrier layers of GaInN formed on a n-AlGaIn cladding layer "105" and n-GaN guide layer "106". Kimura further discloses magnesium doped p-AlGaIn cladding layer "108" and magnesium doped p-type GaN optical guide layer"109"(see background invention). Kimura et al discloses in the background invention, even layers of multiple layers of GaN are formed on flat surface of the sapphire substrate (see fig.1 and fig.2 and related description). Kimura do not

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discloses the starting substrate is GaN having tilted crystal orientation from $\langle 0001 \rangle$ direction by angle which is equal to or greater than about 0.5 and less than 2 degrees. Inherently the active layer is formed from the substrate by a distance greater than or equal to one micron.

Zauner et al teaches growing GaN layer on GaN substrate as a homo-epitaxial growth at tilted angle of 0, 2, 4 degrees to obtain GaN layers with two orders of magnitude reduction in density of grown hillocks as compared to homo-epitaxial films grown on $\langle 0001 \rangle$ direction or hetero-epitaxial growth such as GaN on the sapphire substrate. Zauner particularly teaches obtaining smoother layers due to suppression of formation of hexagonal pyramids of GaN growth because GaN is grown on GaN substrate with off-angle orientation from $\langle 000-1 \rangle$ direction or inherently $\langle 0001 \rangle$ (see abstract and the introduction section).

Zauner et al presents the results GaN grown on GaN substrate off-oriented from $\langle 000-1 \rangle$ direction with GaN grown on GaN substrate with $\langle 0001 \rangle$ orientation (table. 1). Zauner teaches the substrate is (000-1) or (0001) plane, which supports newly amended claim limitation of substrate having (0001) (see introduction section, lines 8-11). It would have been obvious to one of ordinary skill in the art to replace sapphire substrate with GaN substrate having off-orientation from $\langle 0001 \rangle$ direction for the benefit of obtaining smoother layers with less density of grown hillocks by two orders of magnitude in homo-epitaxial growth of GaN on GaN at tilt angle from $\langle 0001 \rangle$ direction compared to hetero epitaxial growth of GaN on sapphire $\langle 0001 \rangle$ direction. Modified invention of

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Kimura, as modified by the teaching of Zauner, would have active layer with surface roughness which is equal to or less than a thickness of well layer in the quantum well structure because same technique of homoepitaxial growth of GaN would be grown on GaN substrate with tilt angle of 0, 2, 4 degrees or inherently broadly from 0-4 degrees, tilted away from $\langle 0001 \rangle$ direction to $\langle 11-20 \rangle$. Though Zauner do not exemplify the tilt angle in recited range, it would have been obvious to one of ordinary skill in the art to see reduced the hillock density in the invention of Zauner for any given tilt angle chosen from the claimed range. However, Zauner et al teach as the tilt angle increases from 0 to 2 to 4 degrees the hillock density decreases in gradation (see table.1). Hence, it would have been obvious to one of ordinary skill in the art to see reduction in hillock density from 0 to 4 degrees, including instant claimed range, in gradation.

Response to Arguments

Applicant's arguments filed on 12/28/04 have been fully considered but they are not persuasive. Applicant argues that that neither Kimura nor Zauner teach nitride compound semiconductor light emitting device as presently claimed especially amended limitation of " a nitride compound semiconductor light emitting device including " a GaN substrate having (0001) plane whose crystal orientation is tilted away from a $\langle 0001 \rangle$ direction by an angle which is equal to or grater than about 0.05 degrees and less than about 2 degrees.

Zauner discloses GaN layer grown on GaN substrate, where the substrate is either (000-1) or (0001) plane. Zauner et al teaches GaN substrate

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is nitrogen-side (000-1) of the GaN obtained by mechanical polish and where as Ga side of the GaN (0001) plane is obtained by mechanical polish and reactive ion etching (see Introduction, second paragraph). Zauner et al teaches either plane (0001) or (000-1) as epi-ready for homo-epitaxy. Though Zauner et al teach either plane is suitable for homo-epitaxy, Zauner preferred (000-1) GaN as preferred plane because (0001) GaN plane smoother than (0001) GaN with tilted angle. Zauner et al teaches three examples of tilt angles, which are 0, 2, 4 degrees from (0001) or (000-1) direction to $\langle 11\bar{2}0 \rangle$ (see page W 6.3.3). Zauner et al specifically mention as tilt angle increases, the hillock density decreases (see Table .1 and related description), which is the purpose of the instant claimed process. With respect to amended claim tilt angle range is greater or equal than 0.05 to less than 2 degrees. Though Zauner do not exemplify the tilt angle in recited range, it would have been obvious to one of ordinary skill in the art to see reduced the hillock density in the invention of Zauner for any given tilt angle chosen from the claimed range.

Applicant argues that the preferred range of tilt angle is different from the tilt angle range in the instant claims, and applicant also mention the Zauner et al teaches the tilt angle at 4 degrees works better than tilt angle at 2 degrees. However, Zauner et al teach as the tilt angle increases from 0 to 2 to 4 degrees the hillock density decreases in gradation (see table.1). Hence, it would have been obvious to see reduction in hillock density from 0 to 4 degrees, including instant claimed range, in gradation.

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THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Savitri Mulpuri whose telephone number is 571-272-1677. The examiner can normally be reached on Mon-Fri from 8 to 4.30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt, can be reached on 571-272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public

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PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Savitri Mulpuri
Primary Examiner
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